temperature drop and friction loss in the flue pipe cannot be calculated accurately,[7] and the resistance of various chimney connections is uncertain; the minimum calculated heights should have a generous factor of safety applied to allow for these and other uncertainties. Where ample height cannot be provided, forced or induced draft should be provided. Extreme care should be used in the application of forced draft to avoid producing a pressure in the combustion chambers, because they are not usually designed to avoid the leakage of toxic gases which might result.

Induced draft by means of motor-driven fans or blowers will solve low-draft problems, but would usually be employed for residential systems only as a last resort. Operation of a blower entails some cost, introduces maintenance requirements, and may be dangerous in event of power failure unless suitable protective devices are used. Induced draft fans designed

TABLE 3. DRAFTS REQUIRED BY TYPICAL RESIDENTIAL HEATING DEVICES OR APPLIANCES

DEVICE	DRAFT, INCHES WATER	STACK TEMPERATURE[c] F DEG
Space Heater, Oil Burning, Pot Burner	0.06 to 0.08	1000
Warm Air Furnace, Oil Burning, Pot Burner	0.06	860
Warm Air Furnace, Hand Fired	0.06[b]	900
Floor Furnace, Oil Burning, Pot Burner	0.06	860
Mechanical Oil Burner, Less than 5 gph	0.03[a]	—
Mechanical Oil Burner, More than 5 gph	0.05[a] or less	—
Cooking Stove, Solid Fuel	0.04[b]	400
Space Heater, Coal Burning	0.06[b]	900

[a] Draft in firebox. [b] For chestnut sized anthracite. [c] 18 in. from heater.

to resist effects of high temperature and corrosion are available. Fans not carefully designed or modified to meet these conditions should not be applied to this service.

CHIMNEYS FOR GAS HEATING

Since a gas-designed appliance must be able to operate at rated input (plus 10 or 15 percent) without chimney connection, and without producing carbon monoxide, the only function of the chimney is to remove the products of combustion from the room. The chimney provides draft to overcome the friction in the flue pipe and chimney, but does not draw air into the appliance.

Chimneys for venting appliances designed for burning gas, can therefore be low in height, but must have adequate area. The height is usually established by the building height. Chimney sizes are usually selected on the basis of heat input of the appliance. The chimney sizes adopted by the *American Standards Association* and the *National Board of Fire Underwriters* in 1950 for gas appliances[13] are shown in Fig. 10.

Additional provisions of *ASA* Standard Z21.30-1950 relating to chimney size are:

1. In no case shall the vent area be less than the area of a 3-in. diameter pipe.
2. When more than one appliance vents into a flue or vent, the flue or vent area shall be not less than the area of the largest flue or vent connector plus 50 per cent of the areas of the additional flue or vent connectors.
3. An elliptical flue or vent may be used provided its flue gas venting capacity is equal to the capacity of the round pipe for which it is substituted.

Since Fig. 10 has been prepared for circular flues, relative capacities for rectangular and semi-elliptical flues[14] are shown in Fig. 11.

Heating appliances designed to burn gas, as well as appliances converted to gas burning, except those equipped with power type burners and excepting conversion burner installations in excess of 400,000 Btu per hour input in large steel boilers, are always equipped with a draft hood attached to the flue outlet of the appliance. This draft hood is required if the appliance is to meet the approval requirements of the *American Gas Association* and the *American Standards Association*, and is essential for safe

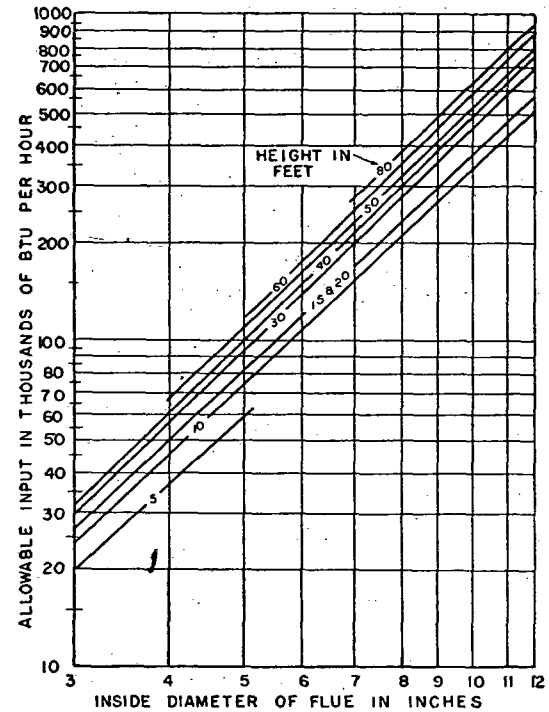

FIG. 10. CAPACITY IN BTU PER HOUR FOR GAS APPLIANCE FLUES OR VENTS

operation. It is designed to prevent excessive chimney draft which would lower appliance efficiency, to prevent a blocked flue or a down-draft in the chimney from impairing combustion, to provide a relief opening for the products of combustion during down-draft or blocked flue conditions, and to prevent spillage of the products of combustion to the space surrounding the appliance, if there is a chimney draft equivalent to that provided by a 3-ft chimney. As the draft hood is designed without moving parts, the relief opening is always open, and consequently some air is drawn into the chimney. This air lowers the gas temperature in the chimney, but it also lowers the dew-point of the gases and tends to prevent condensation.

The installation of conversion burner equipment in large boilers is usually made in accordance with regulations of the local gas company.